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**Minervini**

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(54) **APPARATUS AND METHOD FOR REDUCED STRAIN ON MEMS DEVICES**

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(51) **Int. Cl.**

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| *B81B 3/00* | (2006.01) |
| *B81C 1/00* | (2006.01) |

(52) **U.S. Cl.**

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(58) **Field of Classification Search**

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USPC ........................................................ 257/415

See application file for complete search history.

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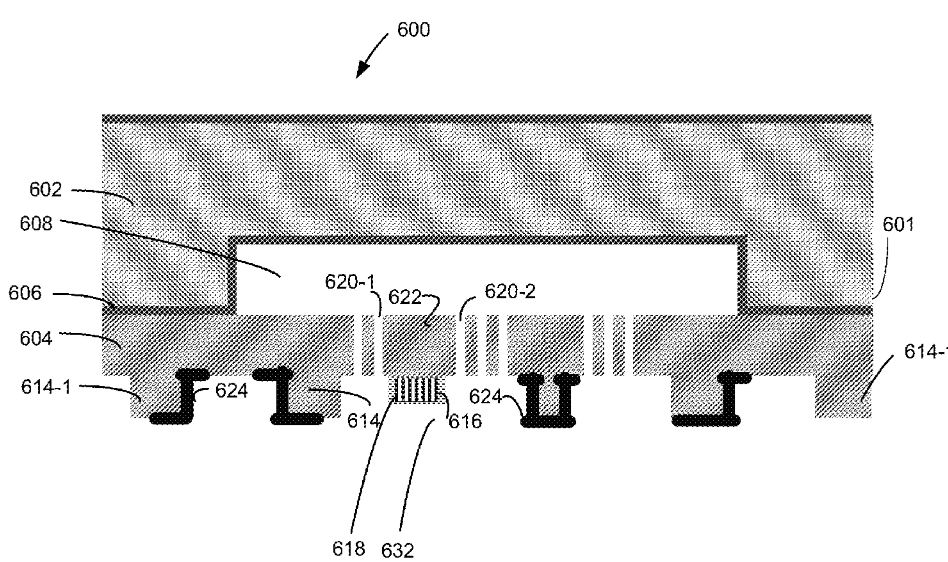
(57) **ABSTRACT**

A method and apparatus for coupling a MEMS device to a substrate is disclosed. The method includes providing a substrate with a conductor disposed over the substrate, adhering the MEMS device to the substrate, wherein a first elastomer adheres the MEMS device to the substrate. The MEMS device is electrically connected to the conductor using a wire bond.

**21 Claims, 8 Drawing Sheets**



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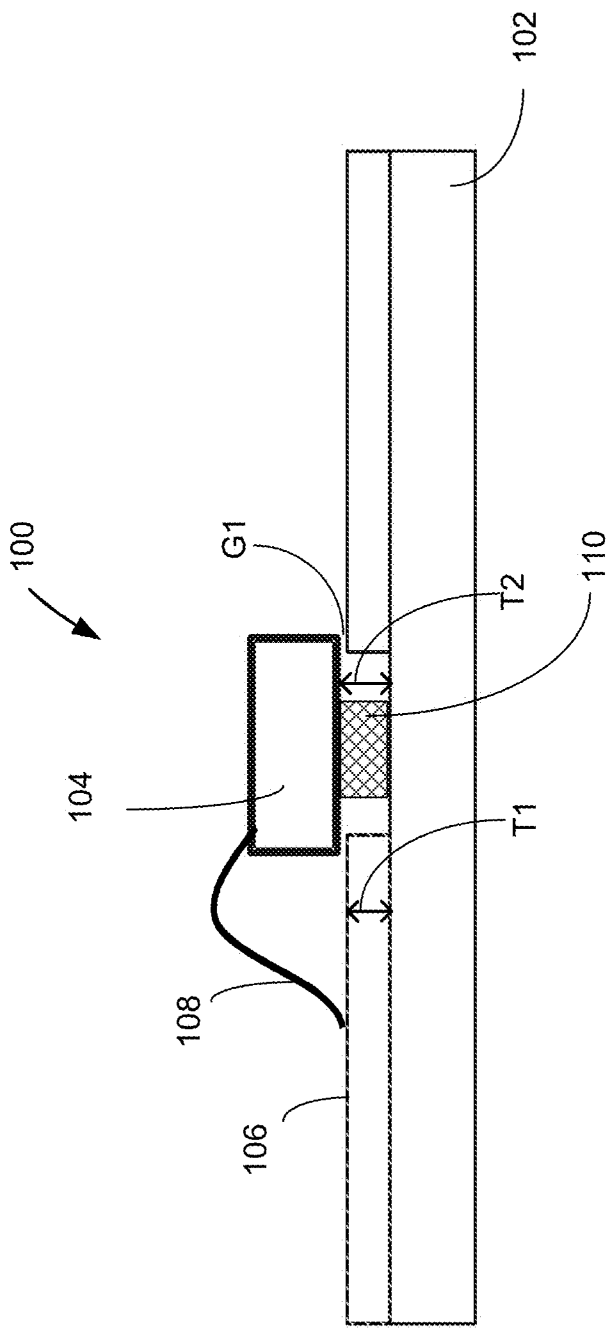



FIG. 1

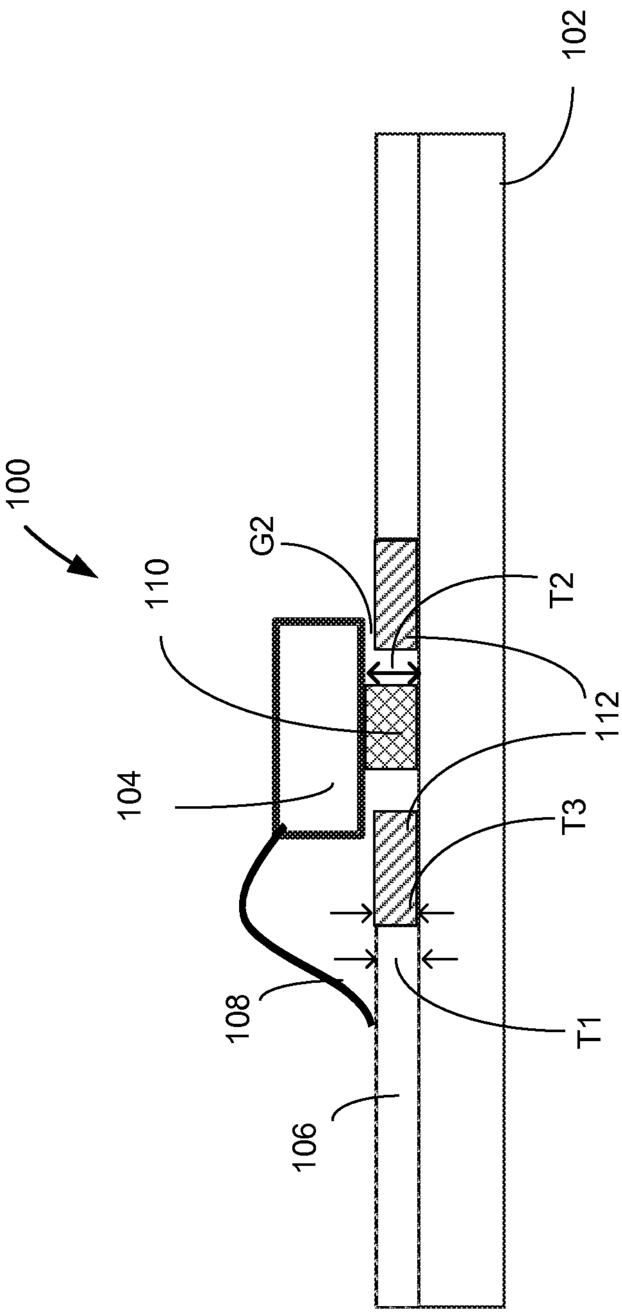



FIG. 2

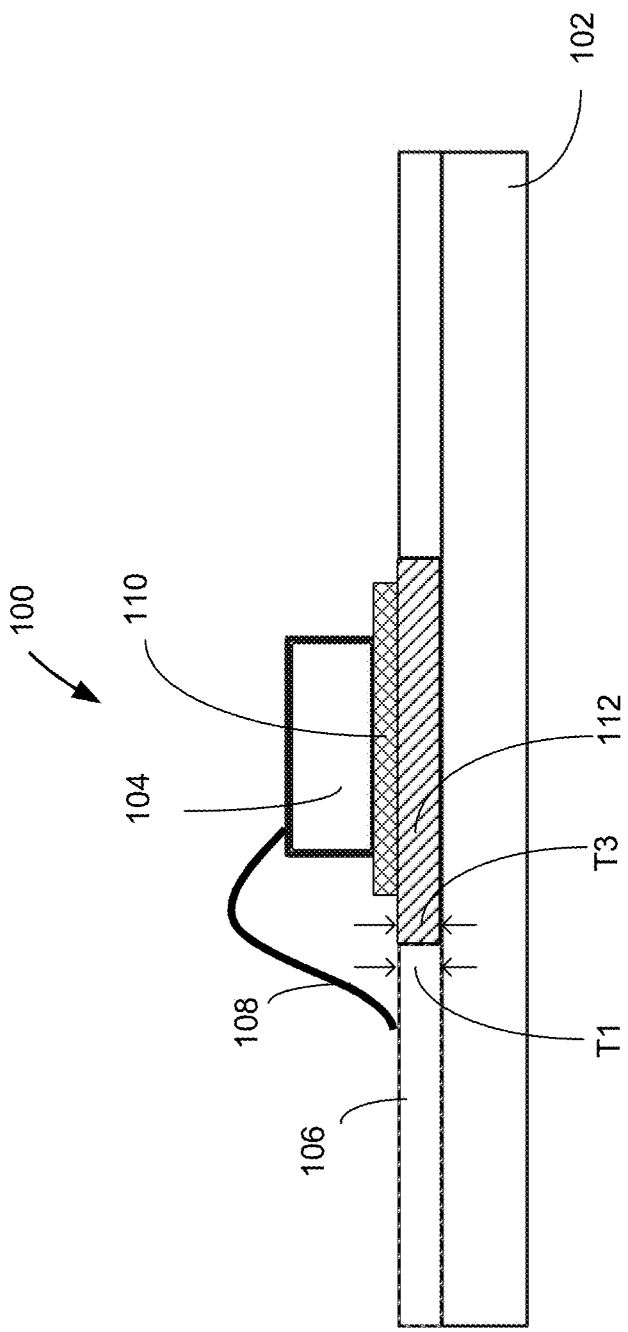



FIG. 3

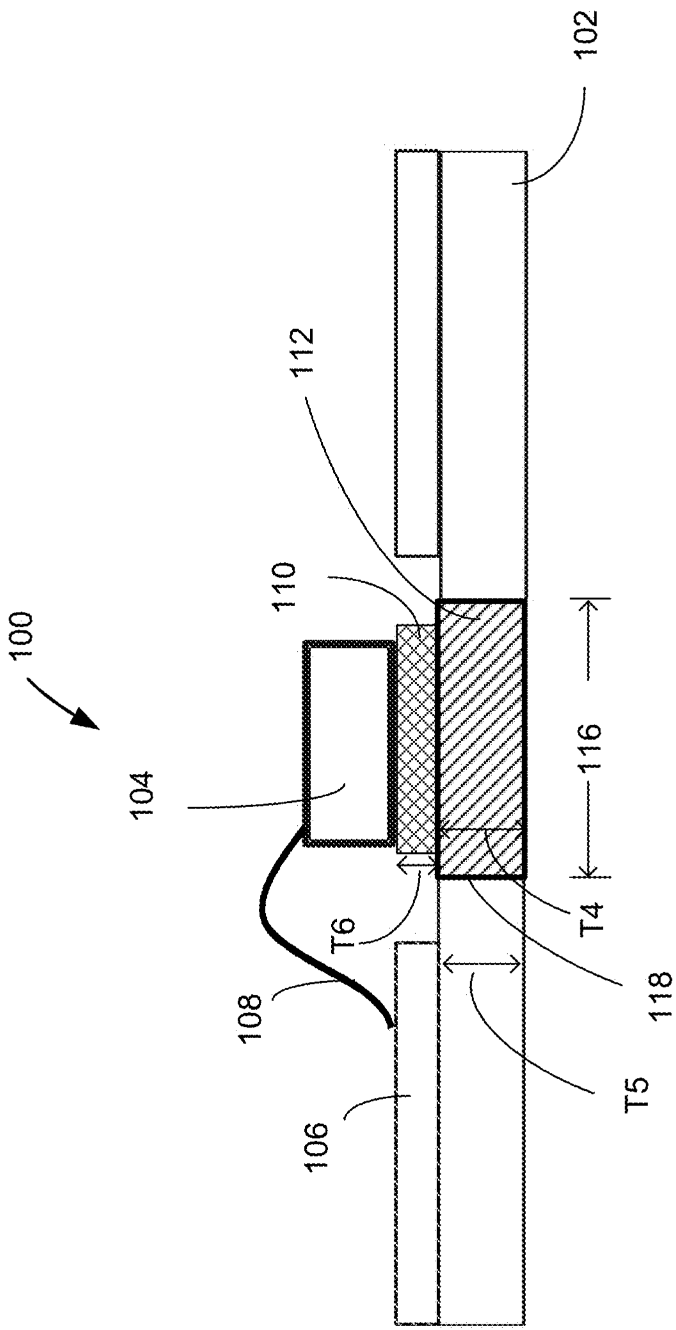



FIG. 4

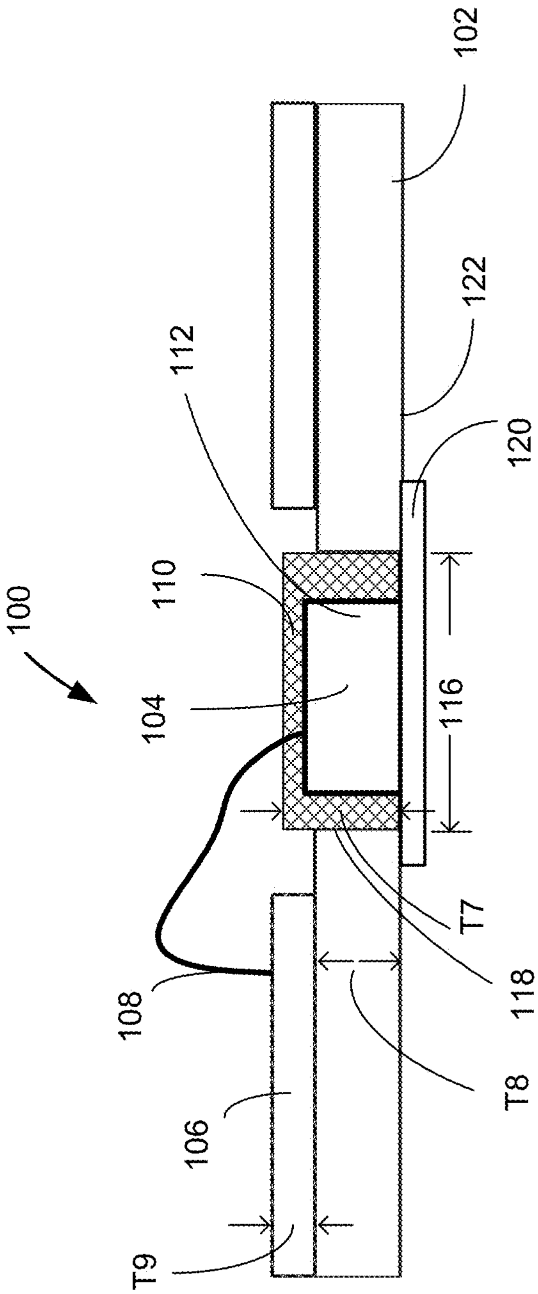



FIG. 5

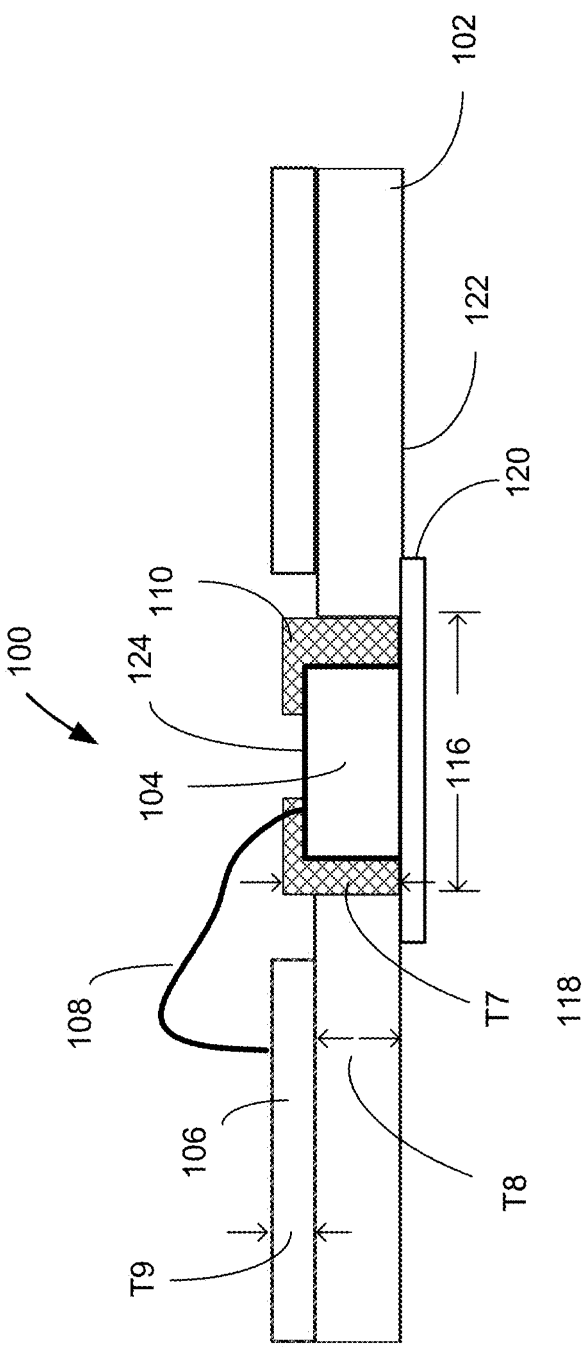
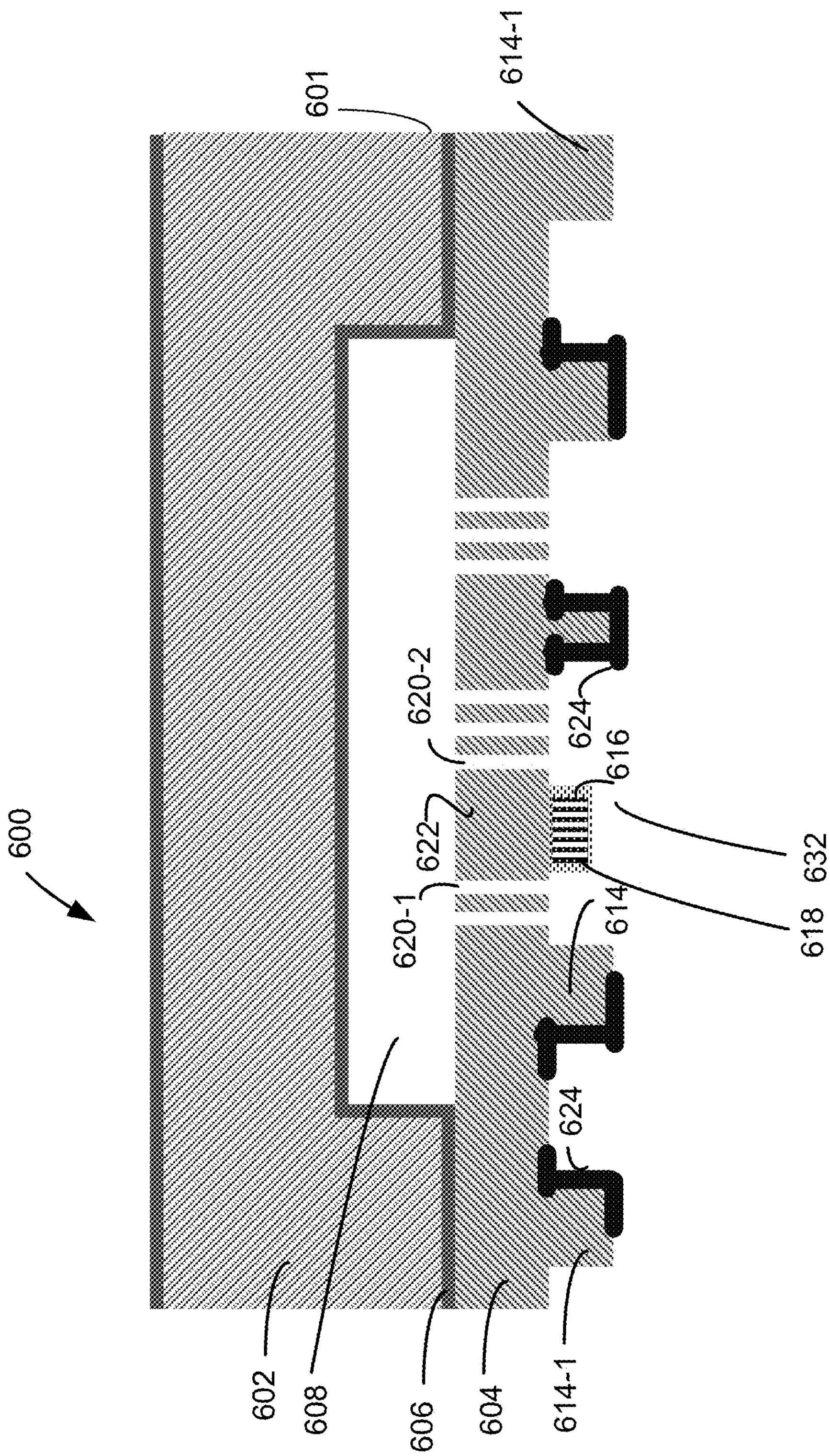



FIG. 5A



600
601
614-1
620-2
624
616
622
632
620-1
614
618
624
602
608
606
604
614-1


FIG. 6

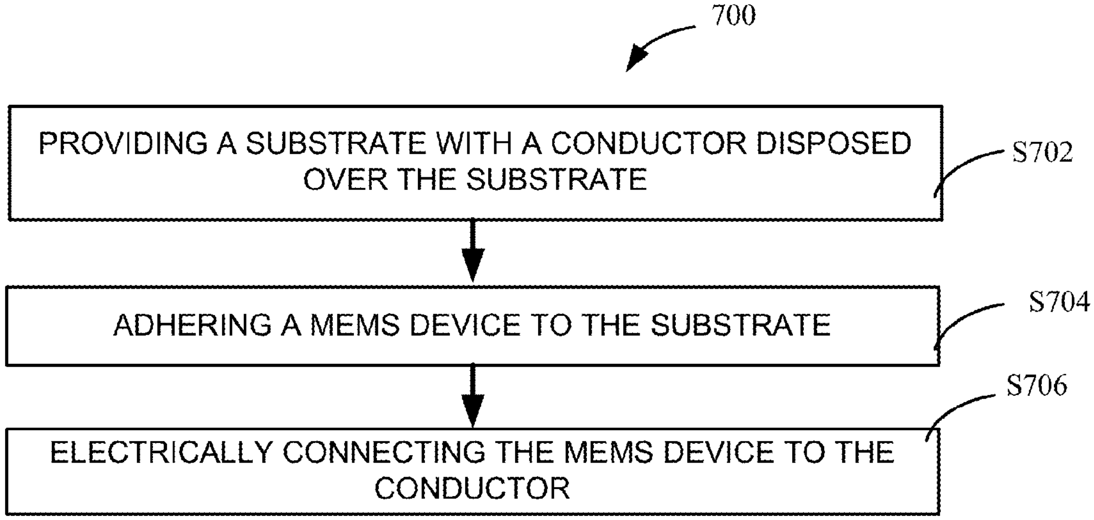

700
PROVIDING A SUBSTRATE WITH A CONDUCTOR DISPOSED OVER THE SUBSTRATE
S702
ADHERING A MEMS DEVICE TO THE SUBSTRATE
S704
S706
ELECTRICALLY CONNECTING THE MEMS DEVICE TO THE CONDUCTOR

FIGURE 7

# APPARATUS AND METHOD FOR REDUCED STRAIN ON MEMS DEVICES

## RELATED APPLICATION

This application claims priority to U.S. provisional patent application 61/857176 filed on 22 Jul. 2013 entitled "Apparatuses and methods for minimized package induced strain on MEMS pressure sensors", which is incorporated herein by reference in its entirety.

## TECHNICAL FIELD

The present invention relates generally to microelectromechanical systems (MEMS) device and more particularly, to packaging of MEMS devices with one or more sensors.

## DESCRIPTION OF RELATED ART

MEMS devices are formed using various semiconductor manufacturing processes. MEMS devices may have fixed and movable portions. MEMS force sensors have one or more sense material, which react to an external influence imparting a force onto the movable portions. The sense material can be the MEMS structural layer or a deposited layer. The MEMS force sensor may be configured to measure these movements induced by the external influence to determine the type and extent of the external influence.

Sometimes, MEMS devices are packaged with other devices. For example, MEMS devices may be packaged with one or more electronic devices. These electronic devices may be disposed on a substrate. In some examples there may be a physical or mechanical connection between the MEMS device and the substrate on which other devices are disposed, in addition to electrical connection. As MEMS devices are configured to measure movements induced by the external influence, it is beneficial to minimize any undue external influences apart from the selective external influences the MEMS device is configured to measure. For example, substrates to which the MEMS device is physically coupled may induce or pass on undesirable stress to the MEMS device. These undesirable external influences may induce false measurements or introduce errors into the measurement capabilities of the MEMS device. It may be desirable to minimize effects of these undesirable external influences to the operational capabilities of the MEMS device.

With these needs in mind, the current disclosure arises. This brief summary has been provided so that the nature of the disclosure may be understood quickly. A more complete understanding of the disclosure can be obtained by reference to the following detailed description of the various embodiments thereof in connection with the attached drawings.

## SUMMARY OF THE INVENTION

In one embodiment an apparatus is disclosed. The apparatus includes a substrate with a conductor disposed over the substrate. A MEMS device is adhered to the substrate, wherein a first elastomer adheres the MEMS device to the substrate. A wire bond electrically connects the MEMS device to the conductor.

In yet another embodiment, a method for coupling a MEMS device to a substrate is disclosed. The method includes providing a substrate with a conductor disposed over the substrate, adhering the MEMS device to the substrate, wherein a first elastomer adheres the MEMS device to the substrate. The MEMS device is electrically connected to the conductor using a wire bond.

This brief summary is provided so that the nature of the disclosure may be understood quickly. A more complete understanding of the disclosure can be obtained by reference to the following detailed description of the preferred embodiments thereof in connection with the attached drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other features of several embodiments are described with reference to the drawings. In the drawings, the same components have the same reference numerals. The illustrated embodiments are intended to illustrate but not limit the invention. The drawings include the following Figures:

FIG. **1** shows a MEMS device, adhered to a substrate, according to one aspect of the present disclosure;

FIG. **2** shows a MEMS device, adhered to a substrate, according another aspect of the present disclosure;

FIG. **3** shows a MEMS device, adhered to a substrate, according to yet another aspect of the present disclosure;

FIG. **4** shows a MEMS device, adhered to a substrate, according to yet another aspect of the present disclosure;

FIG. **5** shows a MEMS device, adhered to a substrate, according to yet another aspect of the present disclosure;

FIG. **5**A shows a MEMS device, adhered to a substrate, according to yet another aspect of the present disclosure ;

FIG. **6** shows an example MEMS device, according to one aspect of the present disclosure; and

FIG. **7** shows a flow diagram to adhere a MEMS device to a substrate, according to one aspect of the present disclosure.

## DETAILED DESCRIPTION

To facilitate an understanding of the adaptive aspects of the present disclosure, exemplary apparatus and method for reduced strain on MEMS device is described. The specific construction and operation of the adaptive aspects of the apparatus and method for reduced strain on MEMS device of the present disclosure are described with reference to an exemplary device with a substrate.

FIG. **1** shows a device **100**, with a substrate **102** and a MEMS device **104**. A conductor **106** is disposed over a surface of the substrate **102**. A wire bond **108** electrically couples the MEMS device **104** to the conductor **106**. One or more electronic circuits (not shown) may be disposed over the substrate and the conductor **106** may be configured to electrically couple the electronic circuit to the MEMS device.

In one example, a first elastomer **110** may be disposed over the substrate **102**. In one example, the first elastomer **110** is configured to adhere to the substrate **102**. The MEMS device is disposed over the first elastomer **110** so that the MEMS device adheres to the first elastomer **110**. In some examples, the first elastomer **110** may have two or more phases. For example, an uncured phase and a cured phase. In uncured phase, the first elastomer **110** may be in a liquid state. However, in a cured phase, the first elastomer **110** may be in a solid state. As one skilled in the art appreciates, although the cured phase is referred to as a solid state, the young's modulus of the first elastomer **110** in a cured phase may be in the order of about 0.5 megapascal to about 5 megapascal. As a comparison, the young's modulus of the substrate **102** may be in the order of 10 gigapascal or more. In some examples, the first elastomer **110** may adhere to the substrate **102**, once it turns to a cured phase. In one example, the first elastomer **110** is disposed over the substrate **102** in an uncured phase and then, the MEMS device **104** is disposed over the first elastomer **110**. When the first elastomer **110** is cured, the first elastomer **110** adheres to the substrate **102** and the MEMS device **104**. Once the first elastomer **110** is cured, the conductor **106** is coupled to the MEMS device **103** using the wire bond **108**.

In some examples, a thickness T**1** of the conductor **106** defines a bond thickness. In some examples, it may be preferable to have a thickness T**2** of the first elastomer **110** to be greater than the thickness T**1** of the conductor **106**, when the first elastomer **110** is in a cured phase. For example, by having the thickness T**2** of the first elastomer **110** greater than the bond thickness T**1**, the MEMS device **104** may be vertically separated from the substrate **102** by a gap G**1**. In some examples, the first elastomer **110** may shrink or collapse when the first elastomer **110** changes its state from an uncured phase to a cured phase. In some examples, the first elastomer **110** may expand when the first elastomer **110** changes its state from an uncured phase to a cured phase. As one skilled in the art appreciates, amount of first elastomer **110** disposed over the substrate **102** in an uncured phase may be suitably adjusted so that the thickness T**2** of the first elastomer **110** in a cured phase is such that a desirable gap G**1** is maintained between the MEMS device **104** and the substrate **102**. Example dimensions for thickness T**1** is about 8 um to about 37 um. Example dimension for thickness T**2** is about 12 um to about 75 um. Example dimension for gap G**1** is about 8 um to about 68 um.

FIG. **2** shows a device **100**, with a substrate **102** and a MEMS device **104**, according to another example. A conductor **106** is disposed over a surface of the substrate **102**. A wire bond **108** electrically couples the MEMS device **104** to the conductor **106**. One or more electronic circuits (not shown) may be disposed over the substrate and the conductor **106** may be configured to electrically couple the electronic circuit to the MEMS device.

In this example, a second elastomer **112** is disposed over the substrate **102**. In some examples, the second elastomer **112** may be similar to first elastomer **110**. For example, the second elastomer **112** may have an uncured phase and a cured phase. In uncured phase, the second elastomer **112** may be in a liquid state. However, in a cured phase, the second elastomer **112** may be in a solid state. As one skilled in the art appreciates, although the cured phase is referred to as a solid state, the young's modulus of the second elastomer **112** in a cured phase may be in the order of about 0.5 megapascal to about 5 megapascal. As a comparison, the young's modulus of the substrate **102** may be in the order of 10 gigapascal or more. In some examples, the second elastomer **112** may adhere to the substrate **102**, once it turns to a cured phase. In one example, the second elastomer **112** is disposed over the substrate **102** in an uncured phase. After the second elastomer **112** reaches a cured phase, first elastomer **110** is disposed over the substrate **110** and the MEMS device **104** is disposed over the first elastomer **110**. When the first elastomer **110** is cured, the first elastomer **110** adheres to the substrate **102** and the MEMS device **104**. Once the first elastomer **110** is cured, the conductor **106** is coupled to the MEMS device **103** using the wire bond **108**.

As one skilled in the art appreciates, in one example, a thickness T**3** of the second elastomer **112** may be substantially equal to the bond thickness T**1**. In some examples, the thickness T**3** of the second elastomer may be lower than the bond thickness T**1**. For example, by having the thickness T**3** of the second elastomer **112** substantially equal to the bond thickness T**1**, the MEMS device **104** may temporarily rest on a top surface **114** of the second elastomer **112**, for example, when the wire bond **108** is being coupled to the MEMS device **104**. In some examples, the second elastomer **112** may act as a bumper, if the MEMS device is moved due to an external shock and the like. In some examples, the second elastomer **112** may shrink or collapse when the second elastomer **112** changes its state from an uncured phase to a cured phase. In some examples, the second elastomer **112** may expand when the second elastomer **112** changes its state from an uncured phase to a cured phase. As one skilled in the art appreciates, amount of second elastomer **112** disposed over the substrate **102** in an uncured phase may be suitably adjusted so that the thickness T**2** of the first elastomer **110** in a cured phase is such that a desirable thickness T**3** is maintained for the second elastomer **112**.

In some examples, the thickness T**2** of the first elastomer **110** may be such that MEMS device **104** may be vertically separated from the top surface **114** of the second elastomer **102** by a gap G**2**. In some examples, the first elastomer **110** may shrink or collapse when the first elastomer **110** changes its state from an uncured phase to a cured phase. In some examples, the first elastomer **110** may expand when the first elastomer **110** changes its state from an uncured phase to a cured phase. As one skilled in the art appreciates, amount of first elastomer **110** disposed over the substrate **102** in a liquid phase may be suitably adjusted so that the thickness T**2** of the first elastomer **110** in a cured phase is such that a desirable gap G**2** is maintained between the MEMS device **104** and the top surface **114** of the second elastomer **112**. Example dimensions for thickness T**1** is about 8 um to about 37 um. Example dimension for thickness T**2** is about 12 um to about 75 um. Example dimension for thickness T**3** is about 12 um to about 75 um. Example dimension for gap G**2** is about ZERO to about 50 um.

FIG. **3** shows a device **100**, with a substrate **102** and a MEMS device **104**, according to yet another example. In this example, the construction of the device **100** is similar to the construction of device **100** described with reference to FIG. **2** in that the device **100** of FIG. **3** includes a first elastomer **110** and second elastomer **112**. However, in this example, the second elastomer **112** is first disposed over the substrate **102** and after the second elastomer **112** is in a cured phase, the first elastomer **110** is disposed over the second elastomer **112** in an uncured phase. Then, the MEMS device **104** is disposed over the first elastomer **110**. When the first elastomer **110** reaches a cured phase, the first elastomer **110** adheres to the second elastomer **112** and the MEMS device **104**. A wire bond **108** electrically couples the MEMS device **104** to the conductor **106**. In one example, the wire bond **108** is electrically coupled after the first elastomer **110** is cured.

In this example, the thickness T**3** of the second elastomer **112** is substantially equal to the bond line thickness T**1**, when the second elastomer **112** is in a cured phase.

FIG. **4** shows a device **100**, with a substrate **102** and a MEMS device **104**, according to yet another example. In this example, the construction of the device **100** is similar to the construction of device **100** described with reference to FIG. **3** in that the device **100** of FIG. **3** includes a first elastomer **110** and second elastomer **112**. However, in this example, the substrate **102** includes an aperture **116**. The second elastomer **112** is first disposed in the aperture **116** of the substrate **102**. For example, the second elastomer **112** adheres to inner wall **118** of the aperture **116** when in a cured phase. After the second elastomer **112** is in a cured phase, the first elastomer **110** is disposed over the second elastomer **112** in an uncured phase. Then, the MEMS device **104** is disposed over the first elastomer **110**. When the first elastomer **110** reaches a cured phase, the first elastomer **110** adheres to the second elastomer **112** and the MEMS device **104**. A wire bond **108** electrically couples the MEMS device **104** to the conductor **106**. In one example, the wire bond **108** is electrically coupled after the first elastomer **110** is cured.

In this example, the thickness T**4** of the second elastomer **112** is substantially equal to a thickness T**5** of the substrate **102**, when the second elastomer **112** is in a cured phase. Thickness T**6** of the first elastomer **110** in a cured phase may be substantially equal to the bond line thickness T**1**. Example dimensions for thickness T**1** is about 8 um to about 37 um. Example dimension for thickness T**4** is about 75 um to about 250 um. Example dimension for thickness T**5** is about 75 um to about 250 um. Example dimension for thickness T**6** is about 8 um to about 37 um.

FIG. **5** shows a device **100**, with a substrate **102** and a MEMS device **104**, according to yet another example. In this example, the construction of the device **100** is similar to the construction of device **100** described with reference to FIG. **4** in that, in this example, the substrate **102** includes an aperture **116**. In this example, the MEMS device **104** is disposed in the aperture **116**. In some examples, a support structure **120** may be disposed on a bottom surface **122** of the substrate **102**. The support structure **120** may partially or fully cover the aperture **116**. For example, the MEMS device **104** may rest on the support structure **120** when the MEMS device **104** is disposed in the aperture **116**. In one example, a wire bond **108** is electrically coupled to the MEMS device **104** and the conductor **106** after disposing the MEMS device **104** in the aperture. Then, the first elastomer **110** is disposed over the MEMS device **104** so that the first elastomer **110** adheres to the inner wall **118** of the aperture and portions of the MEMS device **104**, when the first elastomer **110** reaches a cured phase. In some examples, support structure **120** may be removed after the first elastomer **110** reaches cured phase. A thickness T**7** of the first elastomer **110** in cured phase may be such that it is less than or equal to a sum of the thickness T**8** of the substrate **102** and thickness T**9** of the bond line thickness.

Example dimension for thickness T**7** is about 100 um to about 500 um. Example dimension for thickness T**8** is about 50 um to about 250 um. Example dimension for thickness T**9** is about 12 um to about 37 um.

In this example, the first elastomer **110** substantially encapsulates the MEMS device **104**. In some examples, it may be desirable to have portions of the MEMS device exposed. An example device with such a construction is described with reference to FIG. **5**A.

FIG. **5**A shows a device **100**, with a substrate **102** and a MEMS device **104**, according to yet another example. In this example, the construction of the device **100** is similar to the construction of device **100** described with reference to FIG. **5** in that, in this example, the substrate **102** includes an aperture **116**, the MEMS device **104** is disposed in the aperture **116**, over a support structure **120**. However, in this example, the first elastomer **110** partially encapsulates the MEMS device **104**. A portion **124** of the MEMS device **104** is not covered by the first elastomer **110**. In some examples, portion **124** of the MEMS device **104** may include one or more active elements that may have to be exposed, to perform one or more functions of the MEMS device **104**. For example, if the MEMS device is a pressure sensor or a speaker or a microphone, portion **124** may contain corresponding active elements. In this example, thickness T**7**, T**8** and T**9** may similar to the thickness as described with reference to FIG. **5**.

Now, referring to FIG. **6**, an example MEMS device **600** is described. MEMS device **600** may be similar to MEMS device **104**. MEMS substrate **601** includes a handle layer **602** and a device layer **604**. One or more sensors are formed on the device layer **604**. An example magnetic sensor will be described with reference to the MEMS device **600**. Magnetic sensor may be configured as a compass. As one skilled in the art appreciates, additional sensors may be formed on the device layer, for example, an accelerometer, a gyroscope, a pressure sensor, a microphone and a speaker.

A fusion bond layer **606** bonds the handle layer **602** to device layer **604**, to form an upper cavity **608**, defined by the lower side **610** of the handle layer **602** and upper side **612** of the device layer **604**. Now referring to device layer **604**, a plurality of standoff **614** structures are formed on the device layer **604**, for example, by deep reactive ion etching (DRIE) process. Magnetic films are deposited, patterned and magnetized on the lower side **615** of the device layer **604**, to form a first permanent magnet **616**. The first permanent magnet **616** is oriented in a predefined direction by applying an external magnetic field.

In some embodiments, a protective layer **618** is deposited over the first permanent magnet **616**, to prevent oxidization of the first permanent magnet **616**.

FIG. **6** also shows trench patterns **620-1** and **620-2**, an actuator **622** and device pads **624**. A movable actuator **622** is created by forming a plurality of trench patterns **620-1** and **620-2** on the device layer **604**, for example, using a DRIE process. First permanent magnet **616** is located on the first actuator **622**. Next, device pads **624**, preferably made of germanium alloys are deposited and patterned on the device layer **604**.

In one example, device pads **624** may be configured to be coupled to one or more conductors **106** disposed over substrate **102**, using a wire bond **108** as previously described with reference to FIG. **1** through FIG. **5**A. Wire bond **108** coupled to the device pads **624** provide a communication path to various sensors formed on the device layer **604**. Standoff **614-1** surrounds various devices formed on the device layer **604**. Height of the standoff **614-1**, along with seal ring **630** define height of the lower cavity **632**.

Now, referring to FIG. **7**, an example flow diagram **700** will be described. In block S**702**, a substrate with a conductor disposed over the substrate is provided. For example, a substrate **102** with a conductor **106** disposed over the substrate **102** is provided.

In block S**704**, a MEMS device is adhered to the substrate. For example, MEMS device **104** is adhered to the substrate **102**. In block S**706**, the MEMS device is electrically connected to the conductor. For example, a wire bond **108** may electrically connect the MEMS device to the conductor **106**.

Now, one or more example methods of adhering the MEMS device to the substrate is described. As described with reference to FIG. **1**, a first elastomer **110** is disposed over the substrate **102**. The MEMS device **104** is disposed over the first elastomer **110**. When the first elastomer cures, the first elastomer **110** adheres to the substrate **102** and MEMS device **104**.

In another example, as described with reference to FIG. **2**, a second elastomer **112** is disposed over the substrate **102**. After the second elastomer **112** is cured, first elastomer **110** is disposed over the substrate **102**. The MEMS device **104** is disposed over the first elastomer **110**. When the first elastomer **110** cures, the first elastomer adheres to the substrate **102** and the MEMS device **104**.

In yet another example, as described with reference to FIG. **3**, a second elastomer **112** is disposed over the substrate. The second elastomer **112** adheres to the substrate **102** when cured. After the second elastomer **112** is cured, the first elastomer **110** is disposed over the second elastomer **112**. The MEMS device **104** is disposed over the first elastomer **110**.

The first elastomer **110** adheres to the MEMS device **104** and second elastomer **112**, when cured.

In yet another example, as described with reference to FIG. **4**, an aperture **116** is provided in the substrate **102**. A second elastomer **112** is disposed in the aperture **116**. The second elastomer **112** adheres to the inner wall **118** of the substrate **102**, when cured. After the second elastomer **112** is cured, the first elastomer **110** is disposed over the second elastomer **112**. The MEMS device **104** is disposed over the first elastomer **110**. When the first elastomer **110** cures, the first elastomer **110** adheres to the second elastomer **112** and the MEMS device **104**.

In yet another example, as described with reference to FIG. **5**, an aperture **116** is provided in the substrate **102**. In this example, the MEMS device **104** is disposed in the aperture **116**. In some examples, a support structure **120** may be disposed on a bottom surface **122** of the substrate **102**. The support structure **120** may partially or fully cover the aperture **116**. For example, the MEMS device **104** may rest on the support structure **120** when the MEMS device **104** is disposed in the aperture **116**. In one example, a wire bond **108** is electrically coupled to the MEMS device **104** and the conductor **106** after disposing the MEMS device **104** in the aperture. Then, the first elastomer **110** is disposed over the MEMS device **104** so that the first elastomer **110** adheres to the inner wall **118** of the aperture and portions of the MEMS device **104**, when the first elastomer **110** reaches a cured phase. In some examples, support structure **120** may be removed after the first elastomer **110** reaches cured phase.

In yet another example, as described with reference to FIG. **5**A, the substrate **102** includes an aperture **116**. The MEMS device **104** is disposed in the aperture **116**, over a support structure **120**. Then, the first elastomer **110** is disposed over the MEMS device **104** so that the first elastomer **110** adheres to the inner wall **118** of the aperture and portions of the MEMS device **104**, when the first elastomer **110** reaches a cured phase. However, in this example, the first elastomer **110** partially encapsulates the MEMS device **104**. A portion **124** of the MEMS device **104** is not covered by the first elastomer **110**. In some examples, portion **124** of the MEMS device **104** may include one or more active elements that may have to be exposed, to perform one or more functions of the MEMS device **104**. For example, if the MEMS device is a pressure sensor or a speaker or a microphone, portion **124** may contain corresponding active elements.

In some examples, the substrate **102** may be a CMOS substrate, LGA substrate or any other suitable material for packaging an electronic device. In some examples, the first elastomer and second elastomer may be made of same materials. For example, commercially available silicone die attach adhesives may be used. Some example commercially available silicone die attach adhesives are SEMICOSIL® 988 or DOW® 7920. The benefit of using elastomers is at least twofold. First, they have a very low modulus which results in the elastomer absorbing most of the externally induced strain. This in turn results in the MEMS device experiencing little or approximately none of the externally induced strain. In addition to low modulus, elastomers are non linear materials. This attribute results in the elastomer absorbing the energy that may be inherent in vibratory (high frequency) strains. The elastomer essentially acts as a shock absorber in this situation thereby insulating the MEMS device from external vibrations (high frequency strains).

While embodiments of the present invention are described above with respect to what is currently considered its preferred embodiments, it is to be understood that the invention is not limited to that described above. To the contrary, the invention is intended to cover various modifications and equivalent arrangements within the spirit and scope of the appended claims.



What is claimed is:

**1**. A device, comprising:

a substrate with a conductor disposed over the substrate; and

a MEMS device adhered to the substrate, through a second elastomer,

wherein the second elastomer has an uncured phase and a cured phase and the MEMS device is disposed over the first elastomer after the second elastomer has switched from the uncured phase to the cured phase; and a first elastomer adheres the MEMS device to the substrate, wherein a wire bond electrically connects the MEMS device to the conductor.

**2**. The device of claim **1**, wherein the second elastomer is adhered to the substrate and the MEMS device is configured to rest on the second elastomer.

**3**. The device of claim **1**, wherein the first elastomer has an uncured phase and a cured phase and the MEMS device is disposed over the first elastomer when the first elastomer is in the uncured phase.

**4**. The device of claim **2**, wherein a thickness of the conductor defines a bond line thickness and a thickness of the second elastomer is substantially equal to the bond line thickness.

**5**. The device of claim **1**, wherein the first elastomer is configured to selectively yield so as to permit the MEMS device to selectively rest over a surface of the conductor.

**6**. The device of claim **1**, wherein the first elastomer has an uncured phase and a cured phase and the MEMS device is disposed over the first elastomer before the first elastomer has switched to the cured phase, so as to adhere the MEMS device to the first elastomer when the first elastomer has switched to the cured phase.

**7**. The device of claim **1**, wherein the substrate is provided with an aperture, the MEMS device is disposed in the aperture, the first elastomer disposed between the MEMS device and the substrate to adhere the MEMS device to the substrate.

**8**. The device of claim **7**, wherein the first elastomer is disposed after the wire bond electrically connects the MEMS device to the conductor.

**9**. The device of claim **7**, wherein the first elastomer substantially encapsulates the MEMS device.

**10**. The device of claim **1**, wherein the second elastomer has a Young's Modulus of about 0.5 megapascal to about 5 megapascal in the cured phase.

**11**. The device of claim **3**, wherein the first elastomer has a Young's Modulus of about 0.5 megapascal to about 5 megapascal in a cured phase.

**12**. The device of claim **6**, wherein the first elastomer has a Young's Modulus of about 0.5 megapascal to about 5 megapascal in the cured phase.

**13**. A device, comprising:

a substrate with a conductor disposed over the substrate;

a MEMS device adhered to the substrate, wherein a first elastomer adheres the MEMS device to the substrate through a second elastomer,

wherein the second elastomer is disposed over the substrate, the second elastomer configured to adhere to the substrate,

wherein the first elastomer is disposed over the second elastomer, the first elastomer configured to adhere to the second elastomer; and

wherein the second elastomer has an uncured phase and a cured phase, and the first elastomer is disposed over the second elastomer, after the second elastomer has switched to the cured phase.

**14**. The device of claim **13**, wherein the first elastomer has an uncured phase and a cured phase and the MEMS device is disposed over the first elastomer before the first elastomer has switched to the cured phase, so as to adhere the MEMS device to the first elastomer when the first elastomer has switched to the cured phase.

**15**. The device of claim **13**, wherein a thickness of the conductor defines a bond line thickness and a thickness of the second elastomer is substantially equal to the bond line thickness.

**16**. The device of claim **13**, wherein the substrate is provided with an aperture and the second elastomer is disposed in the aperture.

**17**. The device of claim **16**, wherein the first elastomer has an uncured phase and a cured phase and the MEMS device is disposed over the first elastomer before the first elastomer has switched to the cured phase, so as to adhere the MEMS device to the first elastomer when the first elastomer has switched to the cured phase.

**18**. The device of claim **16**, wherein a thickness of the substrate defines a substrate thickness and a thickness of the second elastomer is substantially equal to the substrate thickness.

**19**. The device of claim **13**, wherein the second elastomer has a Young's Modulus of about 0.5 megapascal to about 5 megapascal in the cured phase.

**20**. The device of claim **14**, wherein the first elastomer has a Young's Modulus of about 0.5 megapascal to about 5 megapascal in the cured phase.

**21**. The device of claim **17**, wherein the first elastomer has a Young's Modulus of about 0.5 megapascal to about 5 megapascal in the cured phase.

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